Rediscovery of *Tylophora linearis* P.I.Forst. (Apocynaceae: Asclepiadoideae) from New South Wales, with revision of its conservation status to vulnerable

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Summary

Forster, P.I., Binns, D. & Robertson, G. (2004). Rediscovery of *Tylophora linearis* P.I.Forst. (Apocynaceae: Asclepiadoideae) from New South Wales, with revision of its conservation status to vulnerable. *Austrobaileya* 6(4): 941–947. Newly discovered populations of *Tylophora linearis* (last collected in 1969) are documented from central New South Wales. An amplified description and diagnostic illustrations are provided. The conservation status of *Tylophora linearis* is reviewed with the recommendation that it be downgraded to Vulnerable. *Tylophora linearis* is newly recorded as a host-plant for the butterfly *Danaus chrysippus petilia*.

Keywords: *Tylophora linearis*; Queensland flora; New South Wales flora; Apocynaceae; Asclepiadaceae; *Danaus chrysippus petilia*; Vulnerable flora

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Introduction

Tylophora linearis P.I.Forst. was named in the most recent revision of this genus for Australia (Forster 1992). A further concise account of the species was provided in the 'Flora of Australia' (Forster 1996). Only four gatherings (including the type collection) have previously been made of *Tylophora linearis*, in 1913, 1915, 1960 and 1969. These four gatherings were all made from widely scattered localities in southern Queensland (near Glenmorgan) through to southern New South Wales (near Temora). The vegetation in all of these four localities has been greatly altered since these collection dates, and the species has been listed as Endangered under the Australian Commonwealth *Environment Protection and Biodiversity Conservation Act,* 1999 (*EPBC*), the Queensland *Nature Conservation Act*, 1994 (*NCA*) and the New South Wales *Threatened Species Conservation Act*, 1995 (*TSCA*). The paucity of adequate herbarium material for this species has meant that no detailed illustrations have been provided to date; an essential aid if rapid identification is to be achieved. This identification problem is compounded by the superficial similiarity of vegetative plants of *Rhyncharrhena linearis* (Decne.) K.L.Wilson and *Marsdenia viridiflora* R.Br.

A small number of populations of *Tylophora linearis* have been recently located in central New South Wales. This has enabled information to be gathered about extant distribution, abundance, habitat and phenological patterns. It has also enabled provision of an expanded morphological description, together with illustrations. A new assessment of the conservation status of *Tylophora linearis* is undertaken using the IUCN criteria (Anon. 2001).

Materials and Methods

This paper is based on herbarium collections at BRI and NSW, together with new collections by D. Binns and G. Robertson (deposited in BRI). The first of the new collections was made as a result of pre-harvest survey in Eura State Forest conducted as part of the standard survey requirement for logging in State forests in NSW. Although *Tylophora linearis* was one of the target species for survey, its discovery was partly serendipitous. Subsequently, on the premise that the species may exhibit

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synchronous flowering over a broader area, specific searches for flowering material were conducted elsewhere. Searches were conducted opportunistically in habitats in the Dubbo area similar to that at the Eura S.F. site, and at a selection of systematic flora survey sites in the Pilliga forests where vegetatively similar plants had been recorded previously. Most of these previous records were sight records, but some were based on vegetative vouchers held at State Forests of New South Wales herbarium at Coffs Harbour, NSW. Sites were selected for ease of access and to represent a relatively wide geographical spread. Opportunities were also taken to search for the species during other flora surveys being conducted at the time.

Taxonomy

Tylophora linearis P.I.Forst., Austral. Syst. Bot. 5: 31 (1992). **Type:** New South Wales. Temora, November 1915, *Dwyer* 802 (holo: NSW).

Herbaceous twiner to c. 2 m long, latex clear. Stems cylindrical, up to 3 mm diameter, glabrous or with scattered indumentum; internodes up to 100 mm long. Leaves petiolate; petioles 1–7 mm long, c. 0.5 mm diameter, channelled on top, with scattered to sparse indumentum, extrafloral nectaries absent from base. Leaf lamina linear-lanceolate, up to 100 mm long and 4 mm wide, glabrous or with scattered indumentum, ± concolorous, venation ± obscure, tip acute, base attenuate to cuneate, adaxial surface dark green, glabrous; abaxial surface dark to medium green, glabrous or with scattered indumentum. Cyme umbelliform, up to 20 mm long and with up to 6 flowers; peduncle cylindrical, up to 23 mm long and c. 0.5 mm diameter, glabrous or with scattered to sparse indumentum; bracts linear to linear-lanceolate, 1–3.5 mm long, 0.3–0.5 mm wide, glabrous or with scattered indumentum. Flowers 2–2.5 mm long, (6–) 18–22 mm diameter; pedicels (3–) 5–8 mm long, glabrous or with scattered indumentum. Sepals lanceolate to lanceolate-ovate, weakly apiculate, 1.5–2 mm long, 1–1.6 mm wide, glabrous, base of each sinus with 1 extrafloral nectary. Corolla rotate, externally olive-green, internally dark purple; tube 1–1.2 mm long, 1.5–2.8 mm diameter, glabrous; lobes lanceolate to lanceolate-ovate, 3.5–5.5 mm long, 1.7–2.5 mm wide, with short indumentum on internal surface that is more concentrated towards tip. Staminal corona 0.5–0.8 mm long, 1.5–2 mm diameter, purple, each lobe rounded to flat-topped, 0.5–0.8 mm long, 0.6–1.1 mm wide. Staminal column c. 1 mm long, 1–1.3 mm diameter; anther appendages truncate to elliptic, 0.4–0.5 mm long, 0.3–0.5 mm wide; alar fissure c. 0.2 mm long. Style-head pentagonal globose, 0.5–0.7 mm long, c. 1 mm diameter, green; ovaries c. 1 mm long and 1 mm diameter, glabrous. Pollinaria 0.2–0.3 mm long, 0.2–0.5 mm wide; pollinia globose, held horizontally to erect, 0.16–0.22 mm long, 0.12–0.18 mm wide; corpusculum oblong, 0.1–0.13 mm long, 0.04–0.05 mm wide; caudicles 0.05–0.1 mm long, c. 0.02 mm wide. Follicles fusiform, 95–100 mm long, c. 5 mm diameter, glabrous, seeds not seen. **Fig. 1.**

***Specimens examined*: Queensland.** Darling Downs District: "Myall Park", Glenmorgan, May 1960, *Blake* 21234 (BRI). **New South Wales.** Eura S.F., c. 18 km SSE of Gilgandra, 31° 51'S, 148° 42'E, Mar 2003, *Binns* 9873 (BRI, NSW); 2 miles [3 km] SW of Mendooran, towards Dubbo, Nov 1969, *Coveny* 2492 (NSW); Goobang N.P., 32° 41'S, 148° 17'E, May 2003, *Robertson* s.n. (BRI); Eura S.F., c. 18 km SSE of Gilgandra, 31° 51'S, 148° 42'E, May 2003, *Robertson* s.n. (BRI); northern boundary of Goonoo S.F. & Coolbaggie Nature Reserve, 31° 58'S, 148° 44'E, May 2003, *Robertson* s.n. (BRI); Crow Mt, Barraba, Nov 1913, *Rupp* (NSW); Pilliga West S.F., c. 30 km NW of Baradine, 30° 45'S, 149° 50'E, May 2003, *Binns* 9879 (BRI).

***Habitat and distribution*:** *Tylophora linearis* occurs most commonly in dense shrubland that may be overtopped by eucalypts. At the Mendooran site, Coveny noted that this species grew in association with *Acacia hakeoides, A. lineata, Myoporum* sp. and *Casuarina* sp. At the newly documented localities in the Dubbo area (Eura S.F., Goobang N.P. and Goonoo S.F./Coolbaggie N.R.), the plants were encountered among dense shrubland of *Melaleuca uncinata* with scattered *M. erubescens* and other shrub species, and in adjacent areas of woodland to open woodland with *M. uncinata* shrub understorey, on flat to gently undulating landscapes at 300–400 m altitude. In Eura S.F., the woodland is variously of *Eucalyptus crebra, E. sideroxylon and Callitris glaucophylla,* in Goobang N.P. it is of *E. microcarpa* and in Goonoo S.F./Coolbaggie N.R., the dominant trees are *E. crebra* and *E. dumosa. Tylophora linearis* individuals have been observed twining

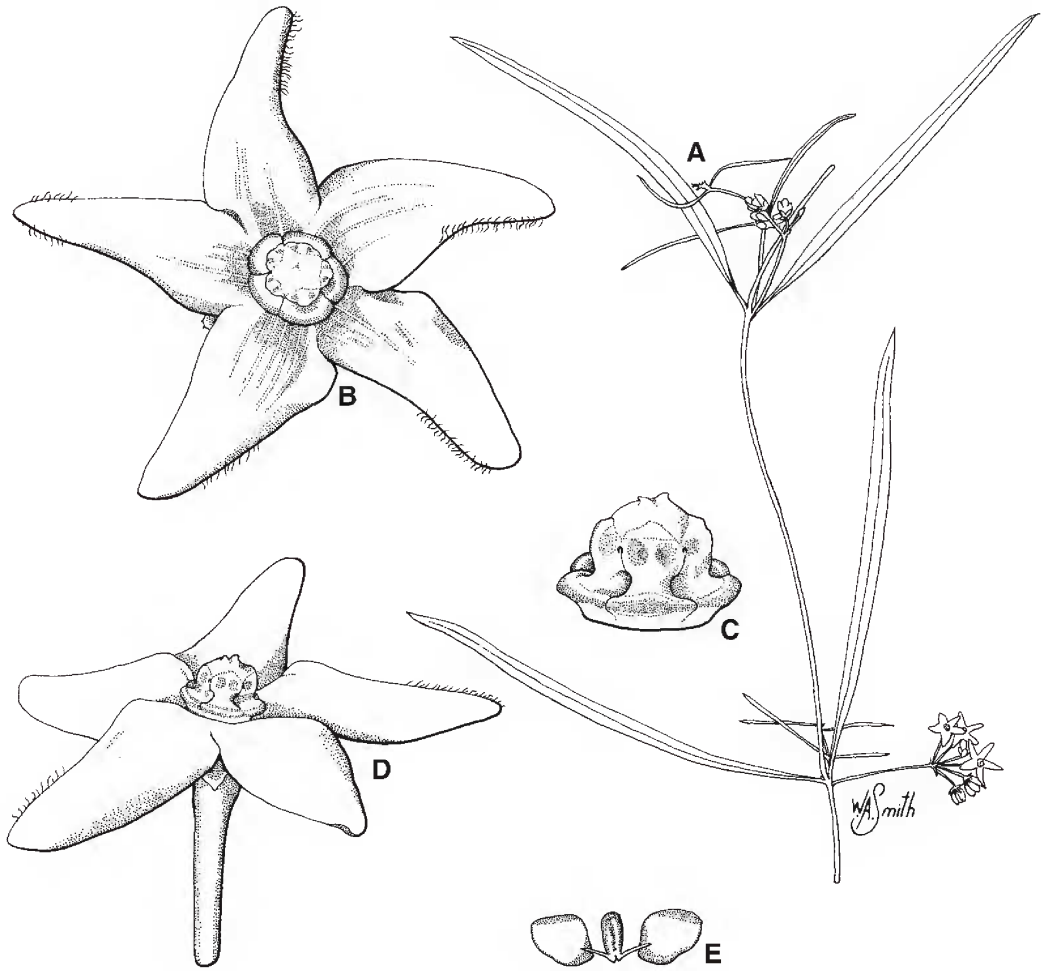

Fig. 1. ***Tylophora linearis***. A. habit of flowering stem. × 0.5. B. face view of flower. × 0.6. C. side view of flower. × 6. D. side view of gynostegium. × 12. E. pollinarium. × 40. All from *Binns* 9873 (BRI). Del. W. Smith.

around the stems of *Melaleuca uncinata,* with the occasional plant twining around *Calytrix tetragona, Acacia tindaleae, Lissanthe strigosa and Leptospermum divaricatum.* The critical habitat defining feature in these areas appears to be the presence of the dense understorey of *Melaleuca uncinata*, however survey has been biased towards these habitats. Recently another location was found in Goobang National Park in *Eucalyptus fibrosa* woodland where *Melaleuca uncinata* is a minor component of the understorey. At this locality *Tylophora linearis* was found on *Dodonaea viscosa* and *Acacia doratoxylon.*

In contrast, the collection from Pilliga West S.F. was from woodland of *E. pilligaensis* and *Callitris glaucophylla*, with a moderately dense subcanopy and understorey of *Allocasuarina luehmannii* and scattered *Acacia hakeoides.* Plants were twining on *A. luehmannii* stems. There is also a sight record of a flowering specimen in Cumbil S.F. (30° 46'E, 149° 04'S, Binns obs. 8 May 2003) from regrowth *Callitris glaucophylla* forest with occasional *E. melanophloia* and *E. crebra*. The understorey comprised scattered shrubs and a sparse grassy ground layer dominated by *Aristida ramosa*, *Digitaria diffusa*, *Aristida*

leichhardtiana, *Whalleya subxerophylla* and *Eulalia fulva*. This site included more than 100 separate shoots over an area of about 0.5 ha, and several shoots with senescent umbels, but only a single flowering specimen. Mature shoots were climbing on fallen dead branches, shrubs of *Geijera parviflora*, *Acacia deanei* and *Hakea decurrens*, and small trees of *Callitris glaucophylla*.

Sight records of vegetatively similar plants have been made over the past ten years from 43 systematic survey sites over the geographic range (28° 55' –31° 57'S and 148° 40' – 150° 55'E). These sites represent a wide range of habitats, but *Callitris glaucophylla* is common in almost half and *Allocasuarina luehmannii* is common in about 25% of sites. Other dominant overstorey species include *E. crebra*, *E. populnea* subsp. *bimbil*, *Casuarina cristata*, *E. albens* and *E. viridis*. *Melaleuca uncinata* is common in only two of these sites. If these records actually do represent *Tylophora. linearis*, as seems likely, then the habitat range is much greater than indicated by the known sites described above.

The recorded, historical latitudinal distribution is from Glenmorgan in southern Queensland in the north (last seen 1960) to Goobang National Park in central New South Wales in the south (**Map 1**).

***Notes*:** The new collections of *Tylophora linearis* have enabled a number of additions and changes to the morphological description of this species (cf. Forster 1992, 1996). Perhaps most significant of these is that plants of this species do not form subshrubs, nor are they particularly woody. Instead *Tylophora linearis* appears to be an herbaceous twiner, a life form that is widespread in Australian asclepiads, particularly those that occur in non-rainforest communities. Plants appear to be perennial, and regenerate from a thickened rootstock. A number of Australian asclepiads are geophytic in lifeform, with the annually produced aerial parts being shed in times of drought (e.g. various *Marsdenia* spp., *Rhyncharrhena linearis*, Nichols *et al.* 1991; Forster 1995). Such a lifeform also tends to reduce the annual timeframe when plants may be noticeable.

A few plants were partially excavated. These were seen to have thickened vertical rootstocks from ground level to a depth of between 5 and 20 cm, where the vertical portion joined a thinner horizontal rhizome. In the one case where the latter was further excavated, it was traced to another shoot. This suggests that the species is clonal to at least some extent, and may be extensively clonal. Large numbers of shoots may represent few genets. Each population included varying proportions of flowering shoots with long internodes that appear to rapidly elongate, and other, shorter shoots with smaller leaves, where apical elongation appears to have slowed or ceased. It appeared that the latter stem type occurred predominantly in open patches where no supporting shrub stems were in close proximity. This was especially evident at the Cumbil S.F. site where numerous short shoots occurred on the cleared road verge and longer flowering shoots were restricted to adjacent forest. It is possible that shoot elongation and subsequent flowering is stimulated to some extent by a shoot encountering a support for climbing.

When compared to the earlier collections, recent collections have significantly larger and longer leaves and larger flowers with longer pedicels and corolla lobes. Whether these differences are population based or more an artefact of the process of specimen preparation is unknown, but the latter seems likely. Several of the early collections are of poor standard.

Floral anthesis is quite variable in this plant and may be correlated with light. Flowers close during the late afternoon with the corolla lobes reflexing forward so that the staminal column is obscured. Under bright light, the corolla lobes reflex so that the corolla lobes lie flat and the staminal column is fully exposed. In one case, flowers which were closed at about 3 pm when collected, opened after brief (less than 30 minutes) exposure to fluorescent light later that evening. Flowers open non-synchronously on different umbels with only one or two flowers open at any one time on any single umbel. These traits of floral behaviour are not unusual in *Tylophora* and have been observed in other species such as *T. benthamii* Tsiang, T. *colorata* C.T.White, *T. erecta* F.Muell. ex Benth., *T. flexuosa* R.Br., *T. glabriflora* (Warb.) Schltr., *T. grandiflora* R.Br., *T. rupicola* P.I.Forst. and *T. williamsii* P.I.Forst. (Forster 1992, 1994).

Flowering cues are unknown, but may be partly related to rainfall. The first collection from Eura S.F. was several weeks after brief but relatively intense rain (estimated about 20 mm), following a long period of drought. Buds and developing inflorescences were numerous and no umbels had bare pedicels from which flowers had fallen, suggesting that anthesis had begun only a few days earlier. Three weeks later, all flowers had fallen from that cohort of umbels and another cohort had developed to the point of anthesis. Further rain fell during that period.

Individuals of *Tylophora linearis* are difficult to distinguish from those of *Rhyncharrhena linearis* or *Marsdenia viridiflora* R.Br. when only juvenile or sterile plants are encountered. *Marsdenia viridiflora* has copious white latex, but *T. linearis* and *R. linearis* both have clear latex. *Tylophora linearis* has a corolla that is valvate and purple, and staminal coronal lobes that are rounded to somewhat flat-topped and do not extend above the style-head, whereas *Rhyncharrhena linearis* has a corolla that is imbricate and purple, and staminal coronal lobes that are saccate and elongated, with tips extending above the style-head (see illustration in Forster 1996) and *Marsdenia viridiflora* has a campanulate corolla that is green-yellow in colour (see illustration in Forster 1995). *Rhyncharhena linearis* usually occurs in drier vegetation communities than *Tylophora linearis* and has a more inland distribution, whereas *Marsdenia viridiflora* is at its southern limit in southern Queensland (apart from a couple of populations in northern New South Wales) and tends to grow in vegetation communities on heavier clay soils.

***Ecology*:** We have little or no information on biotic interactions with *Tylophora linearis.* The pollinator(s) for *Tylophora linearis*, or any other species of *Tylophora* are unknown (Ollerton & Liede 1997). As with most asclepiads, insect-mediated transfer of pollinaria from flower to flower is necessary for pollination.

Larvae of the Lesser Wanderer butterfly (*Danaus chrysippus petilia* (Stoll, 1790)) have been observed at Eura S.F., Goobang N.P. and Cumbil S.F. feeding on foliage of *Tylophora linearis* (G. Robertson and D. Binns, pers. obs., April 2003 at Eura S.F.) and this represents a new host-plant record for this species. Other native host plant records (all Apocynaceae: Asclepiadoideae) for the Lesser Wanderer include *Brachystelma glabriflorum* F.Muell., *Cynanchum carnosum* (R.Br.) Schltr., *C. floribundum* R.Br., *Marsdenia australis* (R.Br.) Druce, *Oxystelma esculenta* (L.f.) R.Br. ex Schult., *Rhyncharrhena linearis, Vincetoxicum christineae* (P.I.Forst.) S.Liede and *V. liebianum* (F.Muell.) S.Liede (Braby 2000). Naturalised asclepiad hosts include *Asclepias curassavica* L., *Calotropis gigantea* (L.) W.T.Aiton, *C. procera* (Aiton) W.T.Aiton, *Gomphocarpus cancellatus* (Burm.f.) Bruyns and *G. fruticosus* (L.) W.T.Aiton (Braby 2000). All of the native host plants are herbs or twiners, usually with reduced foliage (lamina linear to lanceolate). Several of the native host plants have annual stems (*Brachystelma glabriflorum, Oxystelma esculenta, Vincetoxicum christineae, V. liebianum*) and as noted previously for the first listed species (Forster 1991), the larvae are only able to feed on the plants in the relatively short period of time when the shoots are actively being produced. One plant in Goobang N.P. supported two larvae of different instars and had been substantially depleted by feeding. Each larva is likely to require more than one shoot to mature and the effects of larval predation on shoot, flower and fruit production may be locally substantial.

Many of the plants in Goobang N.P. and Eura S.F. were twining on regrowth stems of *M. uncinata* following commercial harvest for broombush, which completely removes stems at about 20 cm above ground level. The size of the regrowth stems indicated the harvest event occurred about 10 years previously. It is probable that the *Tylophora* survived the harvest, but it may also have colonised the area since harvest. Part of the population in Goobang N.P. was burnt by a moderate intensity fire about 12 months prior to observation. The fire killed the aerial parts of the *Melaleuca uncinata* and burnt the foliage and small twigs, but most shrubs were regrowing from basal shoots. The *Tylophora linearis* plants were clearly resprouting from stems which existed prior to the fire, indicating that the plant has an ability to survive at least moderate intensity fire.

Conservation status: *Tylophora linearis* is currently listed as Endangered under Australian Federal (*EPBC*), Queensland (*NCA*) and New South Wales (*TSCA*) legislation. It is an inconspicuous plant that is likely to be overlooked by less than ardent botanical collectors. The relative ease with which several additional localities were found during a short period of specific searching following the initial rediscovery suggests that the apparent rarity may be an artefact of undercollection, at least in the Dubbo–Pilliga area. However, the total known population size and area of occupancy remain small. The broad historical distribution for the species (range of c. 900 km), together with broad scale land clearing during the 20th century, may indicate that the paucity of collections elsewhere is real as well as being an artefact of undercollection. Searches after rain are required in other parts of its historical range.

At Eura State Forest, at least 270 separate shoots, in over 150 clumps, were seen over 0.5 ha, twining around plants of *Melaleuca uncinata* and occasionally other shrubs. At Pilliga West S.F., about 20 shoots were seen over 0.2 ha, mostly twining around *Allocasuarina luehmannii*. At Cumbil S.F., over 100 shoots were seen over 0.2 ha, but at least 80% were small shoots not of flowering size.

Whilst most plants of *Tylophora linearis* have been found closely associated with *Melaleuca uncinata*, this has not meant that the *Tylophora* is correspondingly common where large areas of the *Melaleuca* are present. Nevertheless, the occurrence of this plant, apparently preferentially, in closed shrubland of *Melaleuca uncinata,* may lend clues to extending the known occurrence of *Tylophora linearis*. *Melaleuca uncinata* is widespread in inland Australia from Lake Lucy in Queensland (18° 33'S) to near Bendigo in Victoria (36° 30'S) and westwards to south-west Western Australia. Although the largest and most floriferous populations of *Tylophora linearis* are associated with *Melaleuca uncinata* shrublands, its distribution is not limited to an association with this species.

Despite recent records, the conservation status of *Tylophora linearis* using the criteria defined by the IUCN (Anon. 2001) remains uncertain, particularly in relation to criteria based on estimated population changes. However, the IUCN criteria are based on a time scale of, at most, several decades. The absence of records, other than those reported here, over the last several decades, renders any assessment of recent population changes rather speculative. Known populations occur in habitats which are not subject to any evident significant threat and there is no reason to expect recent or future decline. However, it is unknown whether populations may be subject to extreme fluctuations through unidentified causes. Using a precautionary assessment which assumes such fluctuations are possible, and using known populations only, *Tylophora linearis* meets Endangered criterion B2ac. Alternatively, assuming that extreme fluctuations are unlikely, it meets only the Vulnerable criterion D (fewer than 1000 mature individuals, in five or fewer populations). This is suggested as the most realistic assessment with current information.

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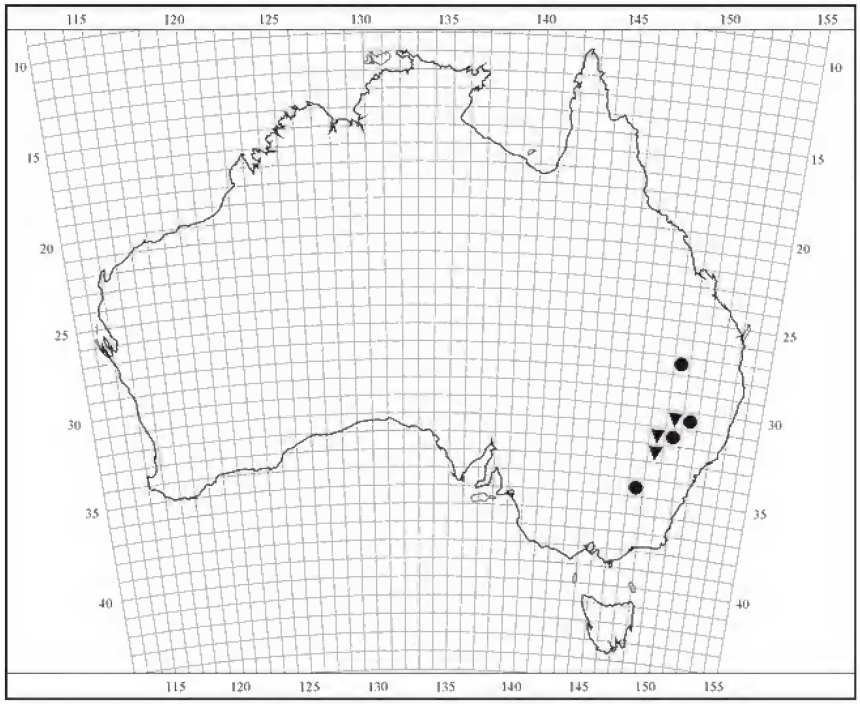

Map 1. Distribution of *Tylophora linearis* in Australia. Records pre 1970 ●, records post 1970 ▼.